CLIMATE CHANGE AND ANIMAL AGRICULTURE: FEDERAL ACTIONS PROTECT THE BIGGEST CONTRIBUTORS FROM THE DISASTERS THEY CAUSE

BY

SHANNA MCCORMACK*

Animal agriculture is a major contributor of greenhouse gases involved in climate change.[1] Current changes in the climate are driving a shift in weather patterns that will cause an increase in frequency and intensity of extreme weather events including heat waves, drought, heavy downpours, floods, hurricanes, wildfires, and winter storms.[2] Consequences of the increased extreme weather events are far-reaching and are expected to substantially impact economic growth,[3] human quality of life, and farmed animals.[4] This Article discusses the connection between animal agriculture emissions and climate change. It examines climate change in several regions of the United States: the Southeast, the Midwest, and the West because while each region will experience drastic changes, the changes will differ greatly. This Article also talks about the federal protections and incentives in place for animal agriculture operations to operate regardless of their environmental impact and how the federal protections further insulate animal agriculture operations from the environmental damage they cause. It then explores options for how these protections can be altered to lessen the environmental impact of animal agriculture operations.

---

*J.D. and Certificate in Environmental and Natural Resources Law 2019 from Lewis & Clark Law School; LL.M in Environmental Law, Natural Resources Law, and Energy Law 2020 from Lewis & Clark Law School. The author would like to thank Professor Raj Reddy both for his kind mentorship and for cold-calling on her in class after she used her passes. It kept her on her toes—and what could better prepare you for the real-world practice of law than that?

1 *Animal Agriculture's Impact on Climate Change*, CLIMATE NEXUS, https://perma.cc/Z7PR-X5TZ (last visited Apr. 10, 2021).

2 *Extreme Weather*, NAT'L CLIMATE ASSESSMENT, https://perma.cc/9JV5-JSM9 (last visited Apr. 10, 2021); *The Connection Between Climate Change and Wildfires*, UNION OF CONCERNED SCIENTISTS (Mar. 11, 2020), https://perma.cc/C5Q8-4NMA.

3 Lydia DePillis, *Most Economic Forecasts Have a Big Blind Spot: Climate Change*, CNN (Aug. 17, 2018), https://perma.cc/7NBN-VFJ2.

4 Nick Cumming-Bruce, *Extreme Weather Tied to Over 600,000 Deaths Over 2 Decades*, N.Y. TIMES (Nov. 23, 2015), https://perma.cc/6HJ4-RDWV; *see infra* notes 151–57 and accompanying text.

I. INTRODUCTION

Animal agriculture produces the same amount of greenhouse gas emissions as all the world's modes of transportation combined.[5] Animal agriculture operations release large amounts of carbon dioxide (CO_2), methane, and nitrous oxide.[6] Per pound, nitrous oxide has 296 times the warming potential of CO_2 and methane has 25 times the potential of CO_2.[7] Animal agriculture also contributes to ocean acidification, which accelerates climate change.[8] Additionally, animal agriculture causes pollution, biodiversity loss, and antibiotic resistance which are also linked to climate change.[9]

Action now to reduce emissions will determine whether the global rise in Earth's temperature is kept under the 2 degrees Celsius (°C) target set in the Paris Climate Agreement.[10] Because animal agriculture is such

---

[5] U.N. FOOD AND AGRIC. ORG., LIVESTOCK'S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS, at xxi, 113 (2006).

[6] FOOD AND AGRIC. ASSOC., LIVESTOCK'S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS xxi (2006).

[7] *Pollution on the Hoof*, L.A. TIMES (Oct. 15, 2007), https://perma.cc/2R8H-XPPS; *Overview of Greenhouse Gases*, U.S. ENV'T PROT. AGENCY, https://perma.cc/5ZHA-R9EW (last visited May 21, 2021).

[8] *See infra* Part II.E.

[9] *See infra* Part II.F.

[10] *The Paris Agreement*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE, https://perma.cc/3A6V-9KG4 (last visited Apr. 11, 2021).

a large contributor of greenhouse gas emissions, the sector's inclusion in the climate discussion can make a large impact on overall emissions. Changes in agriculture alone can determine whether or not warming is kept under 2°C.[11]

The United States Department of Agriculture disaster relief programs, authorized by the Farm Bill, that bail animal agriculture operations out of natural disasters, should be terminated for their contribution to these same natural disasters.[12] Protecting animal agriculture from disasters linked to climate change, and in effect to their very practices, removes responsibility for the externalities that the industry imposes on both a societal and ecological level. Instead, in the next Farm Bill, Congress should either allocate fewer funds to disaster relief programs or spend the funds solely on non-animal related agriculture operations impacted by natural disasters. Animal agriculture operations are often large industrial operations that are in the best position to make determinations on profitability.[13] If these operations are forced to bear the cost of the externalities they impose on the environment and society, they will need to factor this in to their profitability and take actions to mitigate negative externalities.

This Comment explores sources of animal agriculture emissions that contribute to climate change as well as the impacts of climate change caused by these emissions. It then examines three regions in the United States that will be impacted by climate change. It looks at increasing hurricane intensity in the Southeast, intensifying floods in the Midwest, and increasingly destructive wildfires in the West. Each area will experience climate change but will face different natural disasters.[14] Each type of natural disaster both impacts animal agriculture operations and is worsened by the environmental impacts of animal agriculture.[15] This Comment then discusses natural disaster relief programs from the United States Department of Agriculture (USDA) that alleviate the impact of natural disasters on animal agriculture operations. Finally, it analyzes the changes that should be made to the programs to force animal agriculture to pay for the environmental externalities of its operations.

Congress should discontinue the appropriation of disaster funds for animal agriculture in the 2023 Farm Bill and beyond. Additionally, we can each take action to reduce the impact agriculture has on climate change by adopting a plant-based diet, which has a much smaller carbon

---

11 *See infra* Part IV.B.

12 *Disaster Assistance Programs*, U.S. DEP'T OF AGRIC., https://perma.cc/M9ZH-J2CG (last visited Apr. 12, 2021) (describing the various programs providing emergency funding and assistance to farmers).

13 *See Raising Animals in an Industrial System*, FOODPRINT, https://perma.cc/BP5Z-ZE3C (last visited Apr. 12, 2021) (detailing the mass scale of farms that are owned by relatively few companies and sometimes house hundreds of thousands of animals).

14 *See infra* Part III.

15 *Id.*

footprint than a diet that includes animal products.[16] Changing what we eat can alone mean the difference between keeping Earth's temperature under 2°C and preventing the cascade of positive feedback loops that will further accelerate warming if the temperature rises over 2°C.[17] We need government action to stop bailing out animal agriculture, an industry that contributes significantly to climate change, and individual action to change our diets in a way that reduces emissions that cause climate change.

II. CLIMATE CHANGE BASICS, BIGGEST CONTRIBUTORS, AND GENERAL IMPACTS

Climate change is arguably the most pressing issue of our time. Our actions now will determine the landscape for future generations of both human and nonhuman species. With climate change comes disruption to harvests, an increased prevalence of infectious diseases, drought, environmental degradation, and extreme weather.[18] As demographic trends, migration, and urbanization occur in concert with climate change, the most vulnerable populations will face even greater threats to their livelihood and survival.[19]

Changes in climate have already begun to occur. Earth's average temperature has increased by 2° Fahrenheit (F) during the twentieth century.[20] Accompanying this change in temperature, glaciers have shrunk, sea ice has melted, plant and animal ranges have shifted in latitude and elevation,[21] plants have started to flower sooner, sea level has begun to rise, and more intense heat waves have been recorded.[22] These changes are just the tip of the iceberg. The Intergovernmental Panel on Climate Change (IPCC) predicts that the net damage costs of climate change, financial and otherwise, will be significant and will continue to increase for decades to come.[23] IPCC projects an overall temperature rise of 2.5–10°F over the next century.[24]

Climate change is predominantly driven by greenhouse gas production as a result of human activities.[25] The primary greenhouse

---

16 Bingli Clark Chai et al., *Which Diet Has the Least Environmental Impact on Our Planet? A Systematic Review of Vegan, Vegetarian and Omnivorous Diets*, SUSTAINABILITY, Jul. 2019, at 1, 7, 11.

17 *See infra* Part IV.B.

18 U.N. TRUST FUND FOR HUMAN SEC., HUMAN SECURITY: BUILDING RESILIENCE TO CLIMATE THREATS (2017), https://perma.cc/BM8X-SKR5.

19 *Id.*

20 *The Effects of Climate Change*, NASA GLOBAL CLIMATE CHANGE: VITAL SIGNS OF THE PLANET, https://perma.cc/LT3F-WVP3 (last visited Apr. 12, 2021).

21 *Id.*; *Early Warning Signs of Global Warming: Plant and Animal Range Shifts*, UNION CONCERNED SCIENTISTS, https://perma.cc/8T8Q-X5DL (last updated Nov. 10, 2003).

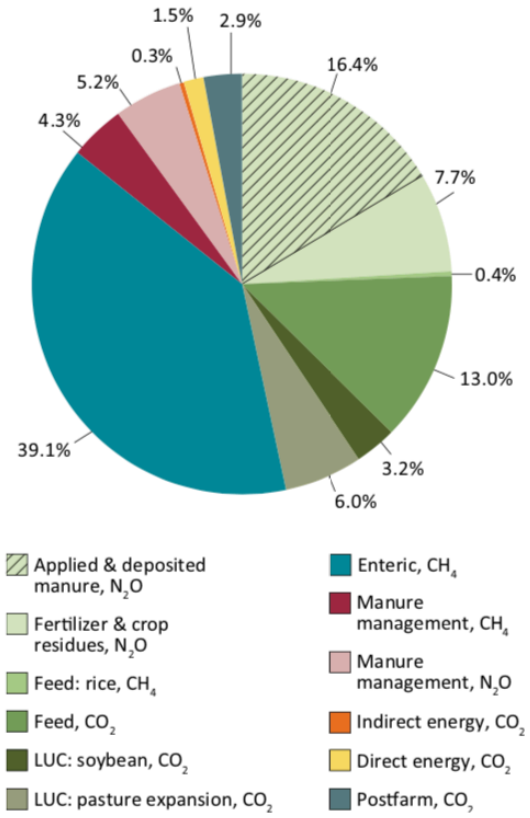
22 *The Effects of Climate Change*, *supra* note 20.

23 *Id.*

24 *Id.*

25 *Id.*

gases contributing to climate change are: carbon dioxide (CO_2), methane, nitrous oxide, and fluorinated gases.[26] CO_2 production is predominantly a result of fossil fuel use but is also emitted through deforestation, land clearing for agriculture, and soil degradation.[27] Methane is mainly produced through agricultural activities, energy use, and biomass burning.[28] In the United States, methane emissions from livestock and those from natural gas are about equal.[29] Nitrous oxide is released through agricultural activities like fertilizer use and fossil fuel combustion.[30] Fluorinated gases in the atmosphere have no natural sources and are entirely a result of human activities such as industrial aluminum manufacturing andthrough their use as a substitute for ozone-depleting substances like refrigerants.[31]



Although CO_2 represents a higher percentage of overall emissions than methane, methane is more efficient at trapping radiation in the atmosphere than CO_2.[32] Per pound, methane has twenty-five times the impact of CO_2 over a 100-year period.[33] Methane's efficiency at trapping radiation in the atmosphere makes its role in climate change particularly impactful. While methane is emitted from energy, industry, and agricultural activities, the largest contributor of

---

[26] *Global Greenhouse Gas Emissions Data*, U.S. ENV'T PROTECTION AGENCY, https://perma.cc/UCL4-HC6W (last visited Apr. 12, 2021).

[27] *Id.*

[28] *Id.*

[29] *The Facts*, COWSPIRACY, https://perma.cc/KQR6-FYYZ (last visited Apr. 12, 2021).

[30] *Global Greenhouse Gas Emissions Data*, *supra* note 26.

[31] *Emissions of Fluorinated Gases*, U.S. ENV'T PROTECTION AGENCY, https://perma.cc/J2AV-PAXY (last visited Apr. 12, 2021).

[32] *Methane Emissions*, U.S. ENV'T PROTECTION AGENCY, https://perma.cc/5FVG-6HAS (last visited Apr. 12, 2021).

[33] *Id.*

methane in the United States is the agricultural sector.[34] Nitrous oxide is another greenhouse gas more efficient than CO_2.[35] Nitrous oxide has 296 times the warming potential of CO_2 and can remain present in the atmosphere for 150 years.[36] Livestock contributes 65 percent (%) of all human-caused emissions of nitrous oxide.[37] A 2013 report by the United Nations Food and Agriculture Organization found that 14.5% of all global greenhouse gas emissions are from livestock.[38] This is the same amount as emissions from all the world's cars, trucks, trains, and airplanes combined.[39]

A. Carbon Dioxide

Animal agriculture releases CO_2 through high-energy feed crop production, factory farm energy requirements, processing and packaging the animals, desertification, and deforestation.[40] Emissions released from the production, processing, and transport of feed make up 45% of emissions from animal agriculture.[41] Beef cattle, followed closely by dairy cattle, contribute the largest amount of CO_2 of all farmed animals.[42] Approximately 65% of the sector's overall CO_2 emissions are from both beef and dairy cattle alone.[43] Just under 10% of total animal agriculture emissions (including CO_2 and other emissions) are a result of CO_2 released through land use change to expand the area in use for feed crop production and pasture expansion for grazing.[44] Of land use change emissions, a major portion is due to the conversion of forests to pasture.[45] Another 25% of CO_2 emissions are due to feed crops produced for animal feed.[46]

---

[34] *Id.*

[35] *The Facts*, *supra* note 29.

[36] *Id.*

[37] *Id.*

[38] *Animal Agriculture's Impact on Climate Change*, *supra* note 1.

[39] *Id.*

[40] HUMANE SOC'Y OF THE U.S., AN HSUS FACT SHEET: GREENHOUSE GAS EMISSIONS FROM ANIMAL AGRICULTURE, https://perma.cc/4T84-ECH2.

[41] P.J. GERBER ET AL., FOOD & AGRIC. ORG. OF THE U.N., TACKLING CLIMATE CHANGE THROUGH LIVESTOCK: A GLOBAL ASSESSMENT OF EMISSIONS AND MITIGATION OPPORTUNITIES 17 (2013), https://perma.cc/Y9NC-672C.

[42] *Id.* at 15–16.

[43] *Id.* at 15.

[44] *Id.* at xii.

[45] Sunil P. Dhoubhadel et al., *Livestock Demand, Global Land Use Changes, and Induced Greenhouse Gas Emissions*, 7 J. ENV'T PROTECTION 985, 991 (2016).

[46] P.J. GERBER ET AL., *supra* note 41.

B. Deforestation

Animal agriculture is the leading cause of deforestation and is responsible for up to 91% of deforestation in the Amazon.[47] Beef, soy, palm oil, and wood production drive the majority of tropical deforestation.[48] In all, deforestation accounts for three billion tons of CO_2 released into the atmosphere each year.[49] Much of the soy produced through deforestation is destined to become animal feed; 80% of soy cultivated in the Amazon is grown for animal feed.[50]

Deforestation contributes to climate change by releasing carbon back into the atmosphere.[51] After trees are cut down for agriculture, they are often left to rot and decompose or are burned—either way—releasing carbon back into the atmosphere.[52] Soils in tropical forests are very nutrient poor and contain only a thin layer of topsoil.[53] Because of this, forest land cleared for agriculture is not conducive to agricultural use in the long-term.[54] When forests are cut, the soil-plant cycle is disturbed, and the soils are vulnerable to soil erosion and chemical changes to the soil that result in the formation of rocklike laterite.[55] Once the nutrients have been depleted from the soil, the next patch of forest is razed and the cycle continues.[56]

C. Methane

Methane is another significant source of greenhouse gas emissions from animal agriculture and makes up around 44% of the sector's total emissions.[57] In the United States, animal agriculture is the largest source of methane emissions.[58] Ruminant animals—such as cattle, sheep, and goats—produce methane as a byproduct of enteric fermentation.[59] This fermentation occurs as their rumens break down carbohydrates into

---

[47] *Animal Agriculture's Impact on Climate Change*, *supra* note 1; *The Facts*, *supra* note 29.

[48] *What's Driving Deforestation?*, UNION CONCERNED SCIENTISTS (Feb. 8, 2016), https://perma.cc/6UVS-Y86E.

[49] *Measuring the Role of Deforestation in Global Warming*, UNION CONCERNED SCIENTISTS (Dec. 9, 2013), https://perma.cc/U3S9-GJF4.

[50] *Soy*, WORLD WILDLIFE FUND, https://perma.cc/8Y4W-X7TZ (last visited Apr. 12, 2021).

[51] *What is the Relationship Between Deforestation and Climate Change?*, RAINFOREST ALLIANCE (Aug. 12, 2018), https://perma.cc/ZZW2-R3LH.

[52] *Id.*

[53] *The Tropical Rainforest*, SOIL-NET, https://perma.cc/GT47-QXLT (last visited Apr. 12, 2021).

[54] *What is the Relationship Between Deforestation and Climate Change?*, *supra* note 51.

[55] *The Tropical Rainforest*, *supra* note 53; *Slash-and-Burn Agriculture: Problems of Tropical Deforestation*, JRANK SCI. & PHIL., https://perma.cc/4DAE-T94U (last visited Apr. 12, 2021).

[56] *What is the Relationship Between Deforestation and Climate Change?*, *supra* note 51.

[57] P.J. GERBER ET AL., *supra* note 41, at 15.

[58] *Methane Emissions*, *supra* note 32.

[59] P.J. GERBER ET AL., *supra* note 41 at 31–32.

simple sugars.[60] Methane is also produced from animal manure as it decomposes.[61] From 1990–2018, methane emissions decreased overall in the United States; however, this was due to a decrease in emissions from landfills, coal mining, natural gas, and petroleum.[62] Over the same time period, methane emissions from animal agriculture increased.[63]

D. Nitrous Oxide

Nitrous oxide is emitted by animal agriculture operations through the application of nitrogen-based fertilizer to fields used to grow feed crops for farmed animals.[64] The increased fertilizer use over the past 50 years is responsible for the rise in atmospheric nitrous oxide concentrations.[65] A study by researchers at the University of California, Berkeley, using data from the Cape Grim Baseline Air Pollution Station in Tasmania, shows empirically that the nitrogen isotope ratio in the atmosphere and how it has changed over the past 50 years is a direct consequence of fertilizer usage.[66] Since 1750, nitrous oxide levels in the atmosphere have risen 20% from under 270 parts per billion (ppb) to over 320 ppb in 2012 when the study was reported.[67] As of February 2021, atmospheric nitrous oxide levels were at 334 ppb.[68]

Further, climate change will increase the amount of nitrogen making its way into United States waterways. With changes in precipitation patterns and increased total rainfall, as well as warmer temperatures due to climate change—an average of 19% more nitrogen will enter our waterways by the end of the century—and this is not including the likely increase in nitrogen application for more intensive agriculture.[69] The increased nitrogen runoff will contribute to more widespread toxic blue-green algae blooms and increase the size of the dead zone in the Gulf of Mexico.[70]

---

[60] *Id.* at 20.

[61] *Methane Emissions*, *supra* note 32.

[62] *Id.*

[63] *Id.*

[64] Robert Sanders, *Fertilizer Use Responsible for Increase in Nitrous Oxide in Atmosphere*, BERKELEY NEWS (Apr. 2, 2012), https://perma.cc/UQ3B-R444; Savannah Kuper, *An Introduction to Livestock and the Climate Crisis*, ENV'T LEADERSHIP, ACTION & ETHICS (Mar. 5, 2014), https://perma.cc/XCB9-9BEF (stating that feed crop production uses synthetic fertilizer).

[65] Sanders, *supra* note 64.

[66] *Id.*

[67] *Id.*

[68] *See Global N_2O Levels*, 2° INST., https://perma.cc/259N-9A72 (last visited June 12, 2021) (providing a line graph of atmospheric nitrous oxide concentrations).

[69] Richard Conniff, *The Nitrogen Problem: Why Global Warming Is Making It Worse*, YALE ENV'T 360 (Aug. 7, 2017), https://perma.cc/FGJ8-YHSR.

[70] Sarah Gibbens, *Massive 8,000-mile 'Dead Zone' Could Be One of the Gulf's Largest*, NAT'L GEOGRAPHIC (June 10, 2019), https://perma.cc/9YVC-X4ZU.

E. Ocean Acidification

Carbon dioxide released as a byproduct from animal agriculture will also contribute to ocean acidification. As the concentration of CO_2 in the atmosphere increases, CO_2 absorbed by the ocean also increases.[71] The oceans absorb around 30% of human-generated CO_2 production.[72] Worldwide, ocean pH is decreasing, and the seas are becoming more acidic due to their absorption of CO_2 from the atmosphere.[73] Since the industrial revolution, the average surface water pH of the world's oceans has decreased from 8.2–8.1, representing a 30% increase in acidity.[74] A rate of change this rapid has never been recorded before in the geologic record of Earth's history.[75] If CO_2 emissions continue through the end of this century, ocean surface waters could be twice as acidic as they were at the end of the last century.[76]

Scientists have demonstrated several impacts that ocean acidification has on sea creatures, such as disrupted predator-prey responses, but many potential changes in inter-species interactions remain uncertain.[77] Ocean acidification is especially harmful to species that build their shells and skeletons from calcium carbonate like clams, mussels, crabs, and corals.[78] When CO_2 enters the water, it reacts with water molecules to form carbonic acid, which then dissociates into bicarbonate and hydrogen ions.[79] The presence of hydrogen ions is what causes the acidification.[80] Because fewer carbonate ions are available in the water for sea life to build shells and skeletons, the likelihood of their successful reproduction decreases.[81] This disruption in reproduction to species that need carbonate causes a disturbance throughout the food chain because these species constitute those at the lowest trophic levels.[82]

Implications are still unknown for species that depend on habitat-forming carbonate-dependent species, like mussels, which form shell aggregations that create habitat on which hundreds of other organisms

---

[71] *CO_2 and Ocean Acidification: Causes, Impacts, Solutions*, UNION CONCERNED SCIENTISTS, https://perma.cc/ZJY8-GNYZ (last updated Feb. 6, 2019).

[72] David Slipher, *UC Davis Explores the Future of Ocean Acidification*, UC DAVIS COLL. BIOLOGICAL SCIS., https://perma.cc/P4F6-HTKL (last visited Apr. 12, 2021).

[73] *Id.*

[74] *Id.*; *CO_2 and Ocean Acidification: Causes, Impacts, Solutions*, *supra* note 71.

[75] Slipher, *supra* note 72.

[76] *CO_2 and Ocean Acidification: Causes, Impacts, Solutions*, *supra* note 71.

[77] *See* Slipher, *supra* note 72 (describing little understood changes in prey behavior resulting from acidified ocean water).

[78] *CO_2 and Ocean Acidification: Causes, Impacts, Solutions*, *supra* note 71.

[79] *Id.*; *The Chemistry of Ocean Acidification*, CLIMATE INTERPRETER, https://perma.cc/6CFQ-CER5 (last updated Dec. 20, 2018).

[80] *The Chemistry of Ocean Acidification*, *supra* note 79.

[81] *See The Effects of Ocean Acidification on the Marine Food Chain*, CLIMATE INTERPRETER, https://perma.cc/5A9C-DUPK (last updated Dec. 20, 2018) (describing how ocean acidification decreases the carbonate available to shell-inhabiting sea life to produce shells, thereby reducing these creatures' likelihood of survival and reproduction).

[82] *Id.*

depend.[83] Additionally, when other climate stressors are present, ocean acidification makes it more difficult for species to recover.[84] For example, coral bleaching can occur when water temperatures get too high, as a result of runoff containing pollutants, from overexposure to sunlight, or from low tides.[85] When bleaching occurs, corals expel the algae living in their tissue with which they have a mutualistic relationship.[86] With the algae expelled, corals are more vulnerable to disease and are less able to build their carbonate skeletal structure.[87] As animal agriculture operations continue to release large amounts of CO_2 into the atmosphere, they will remain a contributor to the increasing acidity of the world's oceans and the harm that results from the increase in acidity.

F. Pollution, Biodiversity, Antibiotic Resistance, and Emissions Projections

Animal agriculture's impacts on planetary health are far-reaching and include more than climate change. It is also the leading cause of water and air pollution and biodiversity loss.[88] Animal agriculture also uses a large proportion of Earth's land, water, and energy resources to raise the seventy billion land animals slaughtered annually for human consumption.[89] Raising these animals uses a third of the planet's ice-free land surface and 16% of global freshwater.[90] Additionally, a third of worldwide grain production is used to feed livestock.[91] Animal agriculture also causes 55% of erosion and 60% of nitrogen pollution.[92]

Farming animals for human consumption also contributes to antibiotic resistance.[93] Approximately 80% of all antibiotics sold in the United States are for use in animal agriculture, 70% of which are medically important to human medicine.[94] They are implemented in animal agriculture through animal feed to increase growth and prevent infections from spreading in closely confined conditions.[95] This practice is expected to spread worldwide over the next fifteen years.[96]

---

83 *See* Slipher, *supra* note 72 (describing scientists' concerns about the loss of habitat-providing species that rely on carbonate for survival).

84 *CO_2 and Ocean Acidification: Causes, Impacts, Solutions*, *supra* note 71.

85 *What Is Coral Bleaching?*, NAT'L OCEAN SERV., https://perma.cc/XWV9-D3UR (last visited Mar. 30, 2021).

86 *CO_2 and Ocean Acidification: Causes, Impacts, Solutions*, *supra* note 71.

87 *Id.*

88 *Animal Agriculture's Impact on Climate Change*, *supra* note 1.

89 *Id.*

90 *Id.*

91 *Id.*

92 *Id.*

93 *Id.*

94 Michael J. Martin et al., *Antibiotics Overuse in Animal Agriculture: A Call to Action for Health Care Providers*, 105 AM. J. PUB. HEALTH 2,409, 2,409 (2015).

95 *Id.*

96 *Id.*

Evidence has shown that widespread antibiotic use for nontherapeutic purposes in animals promotes antibiotic resistance in humans.[97] Antimicrobial resistance causes a significant number of human deaths worldwide; estimates show that the number of these deaths due to resistance could reach up to ten million per year by 2050 and cost a total of one hundred trillion dollars in economic output.[98] The World Bank has also found that antimicrobial resistance could cause the same amount of damage to the world economy as the 2008 financial crisis.[99] According to the World Health Organization, we are "moving towards a post-antibiotic era in which common infectio[n]s will once again kill."[100] Currently, less than 5% of venture capital in pharmaceutical research and development is invested in antibiotic resistance.[101] If trends continue, organ transplantation, joint replacements, and cancer chemotherapy may become too difficult to undertake without effective antibiotics.[102]

As temperatures increase, certain bacteria become increasingly present in healthcare systems and societies.[103] Several recent studies have shown an association between climate change and antimicrobial resistance.[104] A 2019 study found a significant link between warmer temperatures and E. coli and MRSA antibiotic resistance.[105] The first study published on the link was in 2018 and found that as temperature and population density increase, so does antibiotic resistance in common pathogens.[106] It also found that the associations between temperature and antibiotic resistance is consistent across most classes of antibiotics and pathogens.[107] As the human population grows and the planet warms, the impact of antibiotic resistance is likely to be more significant than initially expected.[108]

---

97 *Id.*

98 Brian Turner, *Tackling Antimicrobial Resistance and Climate Change*, 392 LANCET 2,435, 2.435 (2018).

99 *A Global Health Guardian: Climate Change, Air Pollution, and Antimicrobial Resistance*, WORLD HEALTH ORG., https://perma.cc/WL6Y-3UBR (last visited June 12, 2021).

100 *Id.*

101 Turner, *supra* note 98.

102 *A Global Health Guardian: Climate Change, Air Pollution, and Antimicrobial Resistance*, *supra* note 99.

103 Kashmira Gander, *Climate Change Could Worsen Antimicrobial Resistance Threat, Scientists Predict*, NEWSWEEK (Apr. 13, 2019), https://perma.cc/6JNJ-M4HN.

104 *Id.*; *Ecological Study Identifies Potential Association Between Antimicrobial Resistance and Climate Change*, SCIENCEDAILY (Apr. 14, 2019), https://perma.cc/J2D5-HXGE; *Impact of Climate Change on Antibiotic Resistance*, EMERY PHARMA (Nov. 27, 2018), https://perma.cc/H2SJ-9HDA; Derek R. MacFadden et al., *Antibiotic Resistance Increases With Local Temperature*, NATURE CLIMATE CHANGE, June 2018, at 510, 510.

105 Gander, *supra* note 103.

106 MacFadden, *supra* note 104, at 510–14.

107 *Id.*at 511.

108 MacFadden, *supra* note 104, at 514.

Additionally, permafrost worldwide is beginning to thaw due to rising global temperatures.[109] Permafrost is ground that remains frozen year-round and is made up of soil, rock, and sand held together by ice; it covers large regions of the earth, including a quarter of the land area in the northern hemisphere.[110] Most permafrost has remained frozen since the last ice age around 10,000 years ago.[111] Permafrost, which traps carbon in its frozen soil, can be up to a mile thick.[112] As the vast stores of carbon trapped in permafrost are released as the ground thaws, carbon and methane will be released into the atmosphere, creating a positive feedback loop of accelerated warming.[113]

In addition to carbon and methane, permafrost contains bacteria and viruses.[114] Some of these have been dormant for thousands of years and some of which were the cause of past human pandemics, such as the Spanish flu and smallpox.[115] As climate change melts permafrost soils, there is a strong possibility that ancient viruses and bacteria will be released.[116] Only a few years ago, in 2016, in the Yamal Peninsula of the Arctic Circle, a 12-year-old boy died after he contracted anthrax from a reindeer that had been dead for seventy-five years.[117] Scientists theorize that the reindeer's frozen carcass was trapped in permafrost that melted in a 2016 heatwave, releasing the bacteria to over 2,000 reindeer grazing nearby.[118] The grazing reindeer then passed the disease on to humans.[119] While not all bacteria can come back to life after being frozen, some can, and it is still unknown which diseases may resurface as permafrost melts.[120] As global temperatures rise, northern countries will also become more susceptible to outbreaks of diseases usually found in warmer climates where the pathogens that cause the diseases thrive.[121] With the rise of antibiotic resistance and the unearthing of disease-causing bacteria, climate change will only increase the detrimental impacts of antimicrobial resistance.

---

109 Bob Berwyn, *Permafrost Is Warming Around the Globe, Study Shows. That's a Problem for Climate Change*, INSIDE CLIMATE NEWS (Jan. 16, 2019), https://perma.cc/2PZG-BY69.

110 *What Is Permafrost?*, NASA: CLIMATE KIDS, https://perma.cc/RE4V-TCE8 (last visited Apr. 13, 2021).

111 Berwyn, *supra* note 109.

112 *Id.*

113 *Thawing Permafrost*, ENV'T PROTECTION AGENCY: STUDENT'S GUIDE TO GLOBAL CLIMATE CHANGE, https://perma.cc/FXA3-E4C2 (last visited Apr. 13, 2021).

114 Jasmin Fox-Skelly, *There are Diseases Hidden in Ice, and They are Waking Up*, BBC EARTH (May 4, 2017), https://perma.cc/T2B8-M6GL.

115 *Id.*

116 *Id.*

117 *Id.*

118 *Id.*

119 *Id.*

120 *Id.*

121 *Id.*

Animal agriculture operations also contribute to phosphorous pollution, soil erosion, and air pollution.[122] Operations release around 400 different harmful gases into the atmosphere including particulate matter, ammonia, and hydrogen sulfide.[123] In addition to environmental contamination, the industry is rife with environmental justice concerns.[124] While air and water pollution can have a broad impact, communities of color and low-income communities contain a disproportionate number of factory farm and slaughterhouse facilities.[125] In these communities, people are forced to breathe toxic air pollutants from these facilities and because of this, suffer from higher rates of respiratory diseases such as asthma.[126]

Emissions from animal agriculture have increased by 54% from 1961–2010, much of this from methane and nitrous oxide from livestock manure.[127] The impacts of animal agriculture are expected to continue to increase; by 2050, meat consumption is expected to rise by 76% and dairy products by 64%.[128] If the trend toward diets more heavily laden in animal products proceeds unchanged, these diets will be a major contributor to the estimated 80% increase in global agricultural greenhouse gas emissions from food production and land clearing by 2050.[129] Changes made now to the management of animal agriculture, as well as the foods we choose to consume, will in large part, determine how much the planet warms.

III. NATURAL DISASTERS, FARMED ANIMAL IMPACTS, AND THE FUTURE OF CLIMATE CHANGE IN EACH REGION

The impacts of climate change will differ both globally and regionally across the United States. On average, the Midwest will receive warmer and wetter weather, the Southeast coast will see more intense hurricane activity, and the West will face hotter and drier conditions.[130] The Southeastern United States will also experience an increase in summer

---

122 *Animal Agriculture's Impact on Climate Change*, *supra* note 1.

123 Sandi Schwartz, *5 Facts About Animal Agriculture and Air Pollution That You Just Can't Argue With*, ONE GREEN PLANET, https://perma.cc/6XY2-YKTE (last visited Apr. 13, 2021).

124 *Environmental Racism*, FOOD EMPOWERMENT PROJECT, https://perma.cc/8FD4-JYZD (last visited July 16, 2019).

125 *Id.*

126 *Id.*; CARRIE HRIBAR, UNDERSTANDING CONCENTRATED ANIMAL FEEDING OPERATIONS AND THEIR IMPACT ON COMMUNITIES 6 (2010).

127 *Animal Agriculture's Impact on Climate Change*, *supra* note 1.

128 *Id.*

129 David Tilman & Michael Clark, *Global Diets Link Environmental Sustainability and Human Health*, NATURE, Nov. 2014, at 518, 520.

130 *See, e.g.*, *We Broke Down What Climate Change Will Do, Region by Region*, GRIST (Nov. 29, 2018), https://perma.cc/8SZU-2RXW (predicting that the Midwest will experience an increase in temperature-related deaths as temperatures increase; that the Texas Gulf Coast will face sea-level rise and stronger hurricanes; and that temperatures in the West will soon "soar").

thunderstorms and hot, humid weather, including up to one hundred additional warm nights per year by the end of the century.[131] In the Midwest, crop diseases and pest populations will increase as corn yields decline by 5–25% by midcentury.[132] Additionally, the Ogallala Aquifer, which stretches from South Dakota to Texas,[133] on which agricultural irrigation depends, may run dry within twenty-five years.[134] The Southwest is already experiencing heat waves, drought, and wildfires and is running out of water.[135] Megadroughts lasting ten years are expected to become commonplace, and hits to agricultural production will cause food insecurity.[136] Although each region will experience climate change differently, all will face new challenges as they are forced to determine ways to mitigate its impacts.

A. Hurricanes in the Southeast

One major consequence of climate change in the Eastern United States is an increase in intense hurricane activity, which began in the 1970s.[137] Since the mid-1970s, the number of hurricanes that reach category four and five has doubled.[138] Although there will not be an increase in the number of hurricanes—around ninety hurricanes occur globally every year—scientists predict that hurricanes will continue to become more intense with higher wind speeds and more precipitation.[139] The increased intensity paired with a rise in sea level and a growing coastal population will further exacerbate the consequences of increasingly intense hurricane activity.[140]

Sea levels are rising primarily due to glacier and ice sheets melting as a result of warmer air and water temperatures and because water itself expands as it warms.[141] In the past forty years, sea levels have risen an average of four inches globally, and although this small increase in sea level height has not added much to the destruction of hurricanes, by the end of the century levels are projected to rise around one foot, and this

---

131 *Id.*

132 *Id.*

133 Jane Braxton Little, *The Ogallala Aquifer: Saving a Vital U.S. Water Source*, SCI. AM. (Mar. 1, 2009), https://perma.cc/3B9B-WHTY.

134 *We Broke Down What Climate Change Will Do, Region by Region*, *supra* note 130.

135 *See, e.g.*, Cook et al., *Unprecedented 21st Century Drought Risk in the American Southwest and Central Plains*, SCI. ADVANCES 1, 1, 4–6 (2015) (projecting increased temperatures and drought conditions in the Southwest).

136 *Id.* at 1, 4, 6.

137 *Hurricanes and Climate Change*, UNION CONCERNED SCIENTISTS, https://perma.cc/924Z-C68L (last updated June 25, 2019).

138 *Number of Category 4 and 5 Hurricanes has Doubled Over the Past 35 Years*, NAT'L SCI. FOUND. (Sept. 15, 2005), https://perma.cc/V3QP-JGFH.

139 *Hurricanes and Climate Change*, *supra* note 137.

140 *Id.*

141 Henry Fountain, *The Hurricanes, and Climate-Change Questions, Keep Coming. Yes, They're Linked.*, N.Y. TIMES (Oct. 10, 2018), https://perma.cc/BW36-T537.

will lead to increased destruction.[142] Higher sea levels will contribute to hurricane intensity by giving the coastal storm surge a higher starting point as the storm approaches the shore.[143] This will lead to a surge that reaches further inland, particularly in low elevation areas.[144] Growing population density also presents an aggravating factor to the intensity because highly developed coastlines lead to a greater financial impact when storms hit.[145]

Warmer air temperatures will also contribute to intensity of hurricanes because warmer air has a greater capacity than cooler air to hold water vapor.[146] This increased capacity will add fuel to hurricanes and lead to a higher average precipitation rate.[147] Additionally, as ocean temperatures rise along with air temperatures, less cold, subsurface ocean water will be available to weaken hurricanes as they approach shore.[148] As climate change continues to increase hurricane intensity, scientists project a doubling of category four and five storms by the end of the century, with the western North Atlantic facing the largest increase in intensity of storms.[149] Some models project a 45–87% increase in the frequency of category four and five hurricanes for the continental United States, although there may be a slight decrease in the total frequency of hurricanes overall.[150]

The increasingly intense hurricanes have an impact on farmed animals as well. In September of 2018, Hurricane Florence hit North Carolina and killed millions of farmed animals.[151] The North Carolina Department of Agriculture and Consumer Services Counted 3.4 million chickens and turkeys as well as 5,500 pigs.[152] Thirty of the independent farms owned by one of the largest poultry producers in the state were isolated by flood waters, each containing 211,000 chickens.[153] Farmed animal deaths as a result of Hurricane Florence were greater than those from Hurricane Matthew in 2016 and those from Hurricane Floyd in 1999.[154] About half as many animals were killed in Hurricane Matthew as in Hurricane Florence.[155]

---

142 *Id.*

143 *Hurricanes and Climate Change*, *supra* note 137.

144 *Id.*

145 *Id.*

146 *Id.*

147 *Id.*

148 *Id.*

149 *Id.*

150 Nafeez Ahmed, *Catastrophic Hurricanes Are the 'New Normal,' and They Will Cost Trillions*, VICE (Sept. 1, 2020), https://perma.cc/8M52-88UV; *Hurricanes and Climate Change*, *supra* note 137.

151 Zoe Schlanger, *The Farm-Animal Death Toll Continues to Rise in Hurricane Florence Flooding*, QUARTZ (Sept. 19, 2018), https://perma.cc/55YW-DLZN.

152 *Id.*

153 *Id.*

154 *Id.*

155 *The Hidden Victims of Hurricane Florence*, COMPASSION IN WORLD FARMING (Sept. 26, 2018), https://perma.cc/W4QQ-JA4Y.

North Carolina is the second largest pork producer in the United States, with Iowa as the first.[156] The state is also the fourth largest chicken producer in the United States and houses a total of 9.3 million hogs, 819 million chickens, and 33.5 million turkeys.[157] As both demand for animal products and the intensity of hurricanes hitting the east coast rise, the impact on farmed animals in North Carolina will also increase.

B. Flooding in the Midwest

Climate change impacts to the Midwest will result in increases in temperature and precipitation.[158] This shift has already begun. From 1900–2010, the average air temperature increased by over 1.5°F (0.8°C).[159] From 1950–2010, this average increased twice as quickly, and from 1980–2010, it increased three times as quickly as the overall average from 1900–2010.[160] While the amount of future warming is uncertain because it depends on changes in the concentration of atmospheric greenhouse gases, projections for temperature increases in the Midwest put the average temperature at 3.8°F (2.1°C) higher for a scenario with substantial emissions reductions and at 4.9°F (2.7°C) higher for a scenario with continued growth in global emissions by the middle of the century.[161] Projections for the first scenario with a substantial reduction in emissions put the increase in temperature by the end of the century at 5.6°F (3.1°C) and projects an increase of 8.5°F (4.7°C) for a scenario with no reductions.[162]

In addition to temperature increases, the amount of precipitation in the Midwest is also increasing.[163] As temperatures rise, air can hold more moisture, with an average of 7% more water for every degree Celsius.[164] Since 1900, average annual precipitation in the United States has increased around 5%.[165] In the Midwest, precipitation has increased by 9%, the highest of all regions.[166] In addition to an overall increase in precipitation, the number of heavy downpours is on the rise.[167] Since 1991, the amount of rain in heavy precipitation events has increased, with the Midwest and upper Great Plains receiving 30% more than the

---

156 Schlanger, *supra* note 151.

157 *Id.*

158 *Midwest*, NAT'L CLIMATE ASSESSMENT, https://perma.cc/9U2C-T5L2 (last visited Apr. 13, 2021).

159 *Id.*

160 *Id.*

161 *Id.*

162 *Id.*

163 *Precipitation Change*, NAT'L CLIMATE ASSESSMENT, https://perma.cc/FZ2S-NGS4 (last visited Apr. 13, 2021).

164 Umair Irfan, *The Midwest Floods Are Going to Get Much, Much Worse*, VOX (Mar. 27, 2019), https://perma.cc/S6T9-G35V.

165 *Precipitation Change*, *supra* note 163.

166 *Id.*

167 *Heavy Downpours Increasing*, NAT'L CLIMATE ASSESSMENT, https://perma.cc/BS6L-Q546 (last visited Apr. 13, 2021).

1901–1960 average.[168] This has contributed to a greater number and intensity of flooding events in the Midwest.[169]

With wetter weather and more rapidly warming spring seasons, flooding is projected to increase in future years, with events such as the extensive flooding in spring of 2019 becoming common instead of record-breaking.[170] Additionally, if reductions in emissions do not occur, the agricultural sector could lose billions of dollars a year by the middle of the century.[171]

The spring 2019 flooding in the Midwestern United States is an example of weather pattern changes attributable to climate change. As air temperature rises due to climate change, the warmer air will have an increased capacity to store water, and this increased capacity will cause an increase in the number and intensity of future flooding events as large amounts of water are released.

In March of 2019, a "bomb cyclone" hit the central United States, bringing blizzard conditions, severe flooding, and eighty miles per hour winds consistent with those seen in a Category 1 hurricane.[172] Flooding in Nebraska, Iowa, and Missouri was caused by the "bomb cyclone" which carried moisture from the Pacific up to 1,500 miles away.[173] This "bomb cyclone" was triggered by a sudden drop in pressure, which caused the storm to intensify and spin counterclockwise.[174] The drop in pressure occurred when a warm subtropical air mass from the south met a cold Arctic air mass to the north.[175] The resulting "bomb cyclone" caused snow to melt and new rainstorms to bring additional precipitation to the Midwest.[176] The extensive flooding continued for months.[177]

Damage from the flooding has been extensive.[178] Nebraska Governor Pete Ricketts called the flooding the "most widespread disaster we have had in our state's history."[179] A spokeswoman for the Nebraska Department of Agriculture said that she expected their initial farm

---

168 *Id.*

169 Irfan, *supra* note 164.

170 Megan Molteni, *For the Midwest, Epic Flooding is the Face of Climate Change*, WIRED (May 24, 2019, 2:45 PM), https://perma.cc/QG98-XXDM; Samantha Harrington, *Did Climate Change Cause Midwest Flooding?*, YALE CLIMATE CONNECTIONS (Apr. 2, 2019), https://perma.cc/P7MZ-9KYU.

171 Alejandra Borunda, *Climate Impacts Grow, and U.S. Must Act, Says New Report*, NAT'L GEOGRAPHIC (Nov. 23, 2018), https://perma.cc/ZY8M-AB97.

172 Eliza Barclay & Brian Resnick, *A "Bomb Cyclone" Is Bringing Hurricane-Force Winds and Blizzard to the Great Plains*, VOX (Mar. 13, 2019), https://perma.cc/69NZ-G7ZB.

173 Timothy Gardner, *Climate Change's Fingerprints Are on U.S. Midwest Floods: Scientists*, REUTERS (Mar. 21, 2019), https://perma.cc/CMJ4-BF6Z.

174 Barclay & Resnick, *supra* note 172.

175 *Id.*

176 Irfan, *supra* note 164.

177 *Id.*

178 *See Midwest Flooding has Killed Livestock, Ruined Harvests and has Farmers Worried for Their Future*, WHO DES MOINES 13 (Mar. 22, 2019), https://perma.cc/HZ5Z-CCKK (describing farm damage estimates of $400 million for crops and livestock, respectively).

179 *Id.*

damage estimates of $400 million in crop damages and $400 million in lost livestock to increase.[180] Iowa Governor Kim Reynolds, who flew over flooded fields in a helicopter, compared the flooded fields to an ocean where all that could be seen was the tops of grain bins.[181] The United States Secretary of Agriculture Sonny Perdue claimed that the governors of Nebraska and Iowa informed him that up to one million calves may have been killed.[182] On a farm just outside of Omaha, one farmer reported that about 700 of his hogs drowned, many of whom were confined in a barn.[183] The fate of some animals was unknown, such as in the case of one Iowa farmer who knew of six facilities holding 3,000 pigs each, where no one was able to access the flooded buildings to check on the animals.[184] Nebraska, Iowa, and Wisconsin all declared states of emergency in response to the extensive flooding.[185] While the high water levels causing flooding in Iowa and Nebraska receded, snow cover in North and South Dakota remained and flooding occurred there as well; additionally, water levels in the Missouri and Mississippi Rivers along Kansas, Missouri, and Illinois were expected to rise and potentially worsen the moderate flooding that occurred there.[186] While flooding was still ongoing and the full extent of the damage was not yet determined, estimates were in the millions.[187]

C. Wildfires in the West

In the western United States, wildfires are expected to continue to become hotter and more intense as a result of climate change.[188] From 1984–2015, double the amount of western forest area burned than would have in a world without climate change.[189] Seven of California's most destructive wildfires occurred in the past few years.[190] While wildfires primarily affect wildlife, they also impact farmed animals both directly and indirectly through the destruction of grazing lands.[191] Rangelands

---

[180] *Id.*

[181] Christina Maxouris & Jason Hanna, *Historic Floods That Killed 4 and Displaced Hundreds Force 75 Nebraska Cities to Issue Emergency Declarations*, CNN (Mar. 19, 2019), https://perma.cc/UW5R-3CSD.

[182] Peter Szekely, *Pets, Livestock Among Victims of Midwest Flooding*, REUTERS (Mar. 19, 2019), https://perma.cc/4SEE-URLG.

[183] *Midwest Flooding has Killed Livestock, Ruined Harvests and has Farmers Worried for Their Future*, *supra* note 178.

[184] *Id.*

[185] Maxouris & Hanna, *supra* note 181.

[186] *Id.*

[187] *Id.*

[188] Kirk Siegler, *Why Today's Wildfires Are Hotter and More Destructive*, NPR (Aug. 7, 2018), https://perma.cc/PSA9-B7XZ.

[189] Kendra Pierre-Louis & Nadja Popovich, *Climate Change Is Fueling Wildfires Nationwide, New Report Warns*, N.Y. TIMES (Nov. 27, 2018), https://perma.cc/533B-U3B2.

[190] Siegler, *supra* note 188.

[191] Elizabeth Grossman, *Northwest Farms Hit Hard by Wildfires*, CIVIL EATS (Aug. 31, 2015), https://perma.cc/R9BX-9YDP.

are burned, and cattle are caught in fires and killed.[192] The United States Department of Agriculture counts animal deaths due to wildfire in its "adverse weather" category which includes lightning strikes, floods, tornados, hurricanes, and blizzards as well, and does not report the number of deaths by disaster type.[193]

Because of climate change, modern megafires such as those seen in California in 2018 are nearly impossible for firefighters to extinguish.[194] These fires create their own weather systems, which make winds erratic and conditions dangerous for firefighters when attempting to put out the fires.[195] As the fires continue to be fueled by drought, low humidity, and high temperatures resulting from climate change, fires are only predicted to worsen in upcoming years.[196]

In addition to changes in climate, forest management practices over the past century emphasizing suppression of naturally occurring wildfires have led to an unnatural buildup of fuel for fires.[197] Fire suppression was historically favored to protect timber assets; however, it is currently employed to safeguard homes and property.[198] While fire suppression may benefit human interests, many ecosystems in California evolved to be fire-dependent, meaning that they require natural fire cycles as an abiotic factor in maintaining overall ecosystem health.[199] For example, some seeds of plants found in western fire-dependent ecosystems require a fire for germination.[200] Others require long intervals between fires to grow.[201] Fires also clear underbrush from a forest which allows sunlight to penetrate the forest floor, facilitating the growth of grasses, herbs, and shrubs that provide food for wildlife species.[202] Soil nutrients are also released back into the soil as a result of fires.[203] Frequent fires prevent large buildups of underbrush by cycling through fuel, which leads to less intense and destructive future fires.[204] As humans suppressed essential fire cycles from the landscape, this has led to larger and more intense fires that will only be made more intense and destructive as a result of climate change.[205]

---

192 *Id.*

193 Ryan Bell, *What Happens When Livestock Are in the Path of a Wildfire*, NAT'L GEOGRAPHIC (Sept. 3, 2015), https://perma.cc/G5SU-EJY2.

194 Siegler, *supra* note 188.

195 *Id.*

196 *Id.*

197 *Id.*

198 *Id.*

199 *Id.*

200 BUREAU OF LAND MGMT., CHAPTER INTRODUCTION: FIRE ECOLOGY, https://perma.cc/EW5S-FWVE.

201 *Appendix 2: Alliance Fire Regime Characteristics: Terms and Definitions*, CAL. NATIVE PLANT SOC'Y, https://perma.cc/9FDR-GF8K (last visited Apr. 7, 2021).

202 BUREAU OF LAND MGMT, *supra* note 200.

203 *Id.*

204 *Id.*

205 Siegler, *supra* note 188.

Additionally, in the past couple of decades, there has been an increase in development located in high-fire-risk forests and wildlands.[206] According to Headwaters Economics, there are currently two million homes at direct risk of wildfires, with this figure continuing to rise even in the face of climate change.[207] Climate scientists and fire ecologists predict that damages from fires are only going to increase.[208]

IV. USDA'S ROLE IN MANAGING AGRICULTURE AND ITS PRODUCTS AND THE DEPARTMENT'S POTENTIAL TO FIGHT CLIMATE CHANGE

The USDA is the primary authority that regulates the agricultural industry in the United States.[209] The department is made up of smaller Service Agencies which administer categories of programs within the USDA.[210] The most recent Farm Bill,[211] passed on December 21, 2018, authorizes the USDA's food and agricultural programs through September 30, 2023.[212]

The USDA, guided by the Agriculture Improvement Act, more commonly known as the Farm Bill, is primarily in charge of regulating both plant and animal agriculture.[213] The most recent Farm Bill was passed in December 2018 and reauthorized numerous protections for animal agriculture designed to help lessen the financial impact of natural disasters.[214] The Farm Service Agency within the USDA manages the disaster assistance programs authorized in the Farm Bill.[215]

One of these programs is the Livestock Forage Program (LFP), which provides compensation to livestock producers who have suffered losses because of impaired grazing due to drought or fire on land that is native or improved pastureland or land where vegetation has been planted specifically for grazing.[216] Another disaster aid program is the Livestock

---

206 *Id.*

207 *Id.*

208 *Id.*

209 *About the U.S. Department of Agriculture*, U.S. DEP'T OF AGRIC., https://perma.cc/VGS9-FAMU (last visited Mar. 26, 2021).

210 *Agencies*, U.S. DEP'T OF AGRIC., https://perma.cc/YC2C-7QGS (last visited Mar. 26, 2021).

211 Agriculture Improvement Act of 2018, Pub. L. No. 115-334, 132 Stat. 4490.

212 *The Farm Bill*, U.S. DEP'T OF AGRIC. NAT'L INST. OF FOOD AND AGRIC., https://perma.cc/4YDV-4HVA (last visited Apr. 14, 2021).

213 *See Agriculture Improvement Act of 2018: Highlights and Implications*, U.S. DEP'T OF AGRIC. ECON. RES. SERV. (last updated Oct. 1, 2019), https://perma.cc/3PNJ-EGFZ (explaining that much of the U.S. agricultural and food policy is set through the Agriculture Improvement Act); *The Agriculture Improvement Act of 2019 (2018 Farm Bill)*, U.S. DEP'T OF AGRIC., https://perma.cc/F4UL-PSDU (last visited Apr. 7, 2021).

214 *See USDA Update on Farm Bill Implementation Progress*, U.S. DEP'T OF AGRIC. (Apr. 12, 2019), https://perma.cc/J5DR-5RS9 (providing a press release outlining the new 2018 Farm Bill's problems and implementation progress).

215 *Disaster Assistance Programs*, U.S. DEP'T OF AGRIC. FARM SERVICE AGENCY, https://perma.cc/87UQ-JT3S (last visited Apr. 14, 2021).

216 *Id.*

Indemnity Program (LIP).[217] This program provides payments to livestock producers for livestock deaths caused by extreme weather that directly results in the loss of livestock.[218] A third program available to livestock producers is ELAP or Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish.[219] It provides assistance after extreme weather events and wildfires not covered under the first two programs.[220] Another emergency program that USDA administers is the Emergency Conservation Program.[221] This program provides payments to farmers and ranchers to repair damage to farmlands caused by natural disasters and, in particular, to implement emergency water conservation measures during drought.[222] USDA also manages the Noninsured Disaster Assistance Program or NAP, which allocates funds to producers of non-insurable crops when planting is prevented due to natural disasters.[223] This includes crops planted and grown for livestock.[224]

One of USDA's disaster relief programs focuses on events that took place solely in 2017 because it was such a historic year for natural disasters.[225] The 2017 Wildfires and Hurricanes Indemnity Program provides disaster payments to farmers and ranchers to offset losses from hurricanes and wildfires that occurred in 2017.[226] The program was passed in 2018 in the Bipartisan Budget Act of 2018.[227] This new program may be the first of its kind. Natural disaster frequency is on the rise; disasters occur nearly five times as often as they did in the 1970s.[228] As natural disaster frequency and intensity continue to increase, Congress may want to allocate funds to offset losses by farmers and livestock producers from natural disasters.

USDA also has an Emergency Loan Program that it administers to farmers and ranchers to help farmers rebuild following natural disasters once the Secretary of Agriculture or the President of the United States declares the weather event a natural disaster.[229] In the spring of 2019,

---

217 *Id.*

218 *Id.*

219 *Id.*

220 *Id.*

221 *Emergency Conservation Program*, U.S. DEP'T OF AGRIC. FARM SERV. AGENCY, https://perma.cc/4G66-2R5T (last visited Mar. 27, 2021).

222 *Id.*

223 *Noninsured Crop Disaster Assistance Program (NAP)*, U.S. DEP'T OF AGRIC. FARM SERV. AGENCY, https://perma.cc/A6MG-37T9 (last visited Mar. 27, 2021).

224 U.S. DEP'T OF AGRIC. FARM SERV. AGENCY, NONINSURED CROP DISASTER ASSISTANCE PROGRAM (NAP) FACT SHEET (2020), https://perma.cc/TGB5-ZD42.

225 *2017 Wildfires and Hurricanes Indemnity Program (WHIP)*, U.S. DEP'T OF AGRIC. FARM SERV. AGENCY, https://perma.cc/W4RD-9MS9 (last visited Mar. 27, 2021).

226 *Id.*

227 Bipartisan Budget Act of 2018, Pub. L. No. 115-123, 132 Stat. 64 (2018); *2017 Wildfires and Hurricanes Indemnity Program (WHIP)*, *supra* note 225.

228 *WMO Report: The Escalating Impacts of Climate-Related Natural Disasters*, U.N. FRAMEWORK CONVENTION ON CLIMATE CHANGE (July 15, 2014), https://perma.cc/K78M-D4Y8.

229 *Emergency Farm Loans*, U.S. DEP'T OF AGRIC. FARM SERV. AGENCY, https:// https://perma.cc/ZDX2-9EV2 (last visited Mar. 24, 2021).

the President approved a major disaster declaration following the Midwest flooding, which made federal relief loans available under the Emergency Loan Program.[230]

In order to keep climate change below a 2°C increase above pre-industrial levels, as members of the Paris climate agreement have committed to do,[231] animal agriculture should be directly targeted. Given that it contributes the same amount of greenhouse gas emissions as all the world's transportation combined,[232] changes in agricultural practices will have a profound impact on overall warming potential. One way for the United States to help with this is to end USDA aid programs for animal agriculture following disasters. Protecting animal agriculture operations from disasters linked to climate change, and therefore to their very practices, removes any responsibility for the externalities that the industry imposes on both a societal and ecological level. Not all of USDA's disaster relief programs are for the benefit of animal agriculture, although nearly all are. Some programs benefit both animal and plant agriculture and could be altered to exclude animal agriculture. Congress could either allocate fewer resources to the programs or spend the funds solely on non-animal related agriculture affected by disasters.

Without USDA disaster aid programs, animal agriculture operations will need to consider environmental factors in determining their profitability. For example, hog farms in North Carolina may need to move further inland to avoid being submerged as more powerful hurricanes strike the coast in the future. Similarly, hog farms in the Midwest may need to relocate out of flood plains or rebuild farm facilities more suited to higher water levels as the region becomes warmer and wetter from climate change. If the industry is forced to make these changes, many facilities may not remain profitable. Iowa was the number one state for hog operations with 22.7 million pigs in 2018.[233] North Carolina was number two with 8.9 million pigs.[234] The Iowa Pork Producers Association claims that 94% of Iowa's hog farms are family-owned;[235] however, USDA's definition of family farm includes "any farm organized as a sole proprietorship, partnership, or family corporation."[236] In this definition, the size of the farm is also not a factor.[237] Of all farms in Iowa, less than

---

230 Anna Spoerre, *President Trump Announces Major Disaster Declaration for 56 Iowa Counties*, DES MOINES REG. (Mar. 23, 2019), https://perma.cc/U9HG-GDTE; *Emergency Farm Loans*, *supra* note 229.

231 David Roberts, *This Graphic Explains Why 2 Degrees of Global Warming Will Be Way Worse Than 1.5*, VOX (Oct. 7, 2018), https://perma.cc/JH2N-EBWF.

232 *Animal Agriculture's Impact on Climate Change*, *supra* note 1.

233 *Led by Iowa, US Sets Pig Record with 73.5 Million Animals*, DES MOINES REG. (June 28, 2018), https://perma.cc/92M8-Q37T.

234 *Id.*

235 Jackie Meier, *31 Million Pigs Call Iowa Home*, VALLEY NEWS, https://perma.cc/V2G3-CY6N (last updated Dec. 10, 2019).

236 Dan Nosowitz, *Under the USDA's Definition, 90 Percent of Iowa's Farms Are "Family Farms"*, MODERN FARMER (Sept. 17, 2018), https://perma.cc/RX26-RYJS.

237 *Id.*

7% are small or medium-sized farms that are owned by one family.[238] Given that the majority of Iowa's hog farms are owned by larger operations and not independently by families, they are in the best position to afford the expensive changes needed to operate without taxpayer subsidy in the face of climate change disasters. The operations that produce the negative externalities that contribute to climate change will be forced to shoulder the burden of protecting their industry from the consequences of those negative externalities.

If animal agriculture operations are not given USDA disaster aid, the price for animal products will very likely increase and consumption of these products will drop due to this price increase. This drop should not be viewed negatively from an environmental perspective. In the *New York Times* article *The True Cost of a Burger*, Mark Bittman writes that "cheeseburgers are the coal of the food world, with externalities in spades."[239] With a higher cost for animal products following the reduction in subsidies, all of these externalities would be reduced, including those linked to climate change such as carbon dioxide, methane, and nitrous oxide emissions. Overall, a decreased demand for meat will mean fewer greenhouse gas-producing animal agricultural operations operating at full steam, contributing to climate change.

In addition to the environmental benefits, a reduction in the consumption of animal products can lead directly to better overall human health which has an additional impact on reducing emissions that lead to climate change.[240] Consumption of animal-based foods has a large impact on human health. High rates of meat consumption increase the risk of diabetes, heart disease, and stroke.[241] According to the Centers for Disease Control and Prevention, heart disease is the leading cause of death in the United States.[242] Strokes are number five.[243] In 2018, the USDA predicted that Americans would consume a record amount of meat, over 222.2 pounds on average per person.[244] This is over twice the daily amount of meat that nutritionists recommend per day.[245]

---

238 *Id.*

239 Mark Bittman, *The True Cost of a Burger*, N.Y. TIMES (July 15, 2014), https://perma.cc/29MB-8DJE.

240 *See* Lindsay Abrams, *Study: Vegetarians Have Much Healthier Hearts*, ATLANTIC (Feb. 4, 2013), https://perma.cc/TV7X-P8C5 (reporting on a study in the UK which found vegetarians had a lower risk of fatal and non-fatal heart disease than people who ate meat); David Blumenthal & Shanoor Seervai, *To Be High Performing, the U.S. Health System Will Need to Adapt to Climate Change*, COMMONWEALTH FUND (Apr. 18, 2018), https://perma.cc/U9VA-ETLK.

241 Monique Tello, *Eat More Plants, Fewer Animals*, HARV. HEALTH PUBL'G (Nov. 29, 2018), https://perma.cc/UAU6-VPS2.

242 *Leading Causes of Death*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://perma.cc/PM5M-CNFN (last visited Apr. 14, 2021).

243 *Id.*

244 Micheline Maynard, *Veggies May Be Healthier, But in 2018, Americans Will Eat a Record Amount of Meat*, FORBES (Jan. 2, 2018), https://perma.cc/LHF3-4X54.

245 *Id.*

The high demand for healthcare to treat chronic disease is related to diet.[246] The United States healthcare system has a gross domestic product of 3.3 trillion dollars and if our healthcare system was an individual country, it would have the fifth-largest economy in the world.[247] This enormous sector of the United States economy is also the seventh-largest producer of CO_2.[248] In 2011, the sector emitted 655 million tons of CO_2, which was 10% of all CO_2 generated by the United States that year.[249] Decreasing the amount of animal products in our diets can reduce the number of doctors' visits for chronic diseases like heart disease and diabetes and in turn, the demand for healthcare.[250] If everyone in the United States adopted a plant-based diet and removed animal products from their diet, the United States would save 250 billion dollars a year in healthcare services.[251] If there is less demand for healthcare to treat chronic disease because fewer people have chronic diseases, the carbon emissions from healthcare will also decrease as there will be less of a need for these services. Preventative healthcare is the cheapest,[252] and a diet that protects against both poor health and climate change is a win-win for both the environment and human health.

V. CONCLUSION

The bad news is that without immediate and drastic action, climate change is likely to surpass the 2°C warming goal set forth in the Paris climate agreement.[253] A 2017 study found that there is only a 5% chance that Earth will warm by only 2°C by the end of the century.[254] Scientists predict that any warming above the 2°C planetary threshold will increase

---

246 *See Health And Economic Costs of Chronic Diseases*, CTRS. FOR DISEASE CONTROL & PREVENTION, https://perma.cc/J4KG-CFWN (last updated Jan. 12, 2021) (noting that 90% of the $3.8 trillion spent each year in the United States on health care is for people with chronic diseases); *see also* CHRISTINE BUTTORFF ET AL., MULTIPLE CHRONIC CONDITIONS IN THE UNITED STATES (2017) (noting that people with chronic conditions use more health care services and that hypertension and high cholesterol were the most common chronic conditions in 2014); *see also Poor Nutrition*, CTRS FOR DISEASE CONTROL & PREVENTION, https://perma.cc/SL8M-B2T4 (last visited Apr. 14, 2021) (noting a healthy diet reduces the risk of chronic disease).

247 Blumenthal & Seervai, *supra* note 240.

248 *Id.*

249 *Id.*

250 *See* Abrams, *supra* note 240 (reporting on a study that found vegetarians had fewer cases of diabetes, lower blood pressure and cholesterol, and a lower risk of both fatal and non-fatal heart disease than meat eaters).

251 Lauren Cassani Davis, *The Economic Case for Worldwide Vegetarianism*, ATLANTIC (Mar. 28, 2016), https://perma.cc/X28L-6HPA.

252 *See* Thomas Beaton, *How Preventative Healthcare Services Reduce Spending for Payers*, HEALTHPAYER INTELLIGENCE (Aug. 29, 2017), https://perma.cc/57HL-LRYJ (noting that preventative healthcare can prevent patients from developing chronic conditions that account for 75% of the United States' healthcare spending each year).

253 Oliver Milman, *Planet Has Just 5% Chance of Reaching Paris Climate Goal, Study Says*, GUARDIAN (July 31, 2017), https://perma.cc/3ZT2-KU2F.

254 *Id.*

risks dramatically by setting in motion a cascade of positive feedback loops that will continue to cause Earth's temperature to rise even if emissions are curtailed.[255]

In order to avoid catastrophic climate change, we need to act now.[256] The good news is that we can each take immediate action to mitigate the impacts of climate change by altering the way we eat. According to a study in Lancet, a revolutionary change in food systems is needed to meet the environmental goals of the Paris climate agreement.[257] The study found that staying within a 2°C increase in global temperature could be done by switching to plant-based diets and that this switch is even more effective than altering production practices.[258] While changes in food production practices could reduce agricultural greenhouse gas emissions by 10% by 2050, changing to more plant-based diets could reduce emissions by 80%.[259] If we adopt completely plant-based diets, this number could be even greater. Plant-based diets produce the least amount of greenhouse gases.[260] On average, a 2,000 kilocalorie (kcal) high meat diet has over 2.5 times the greenhouse gas emissions of the average 2,000 kcal plant-based diet.[261] Switching from a high-meat diet to a plant-based diet can reduce a person's carbon footprint by 1,560 kilograms of CO_2 per year.[262] If we all make the switch now, we may be able to make the 5% chance of staying under 2°C even if Congress does not act to end USDA aid programs for animal agriculture in the next Farm Bill.[263]

---

255 Dan Lashof, *Why Positive Climate Feedbacks Are So Bad*, WORLD RES. INST. (Aug. 20, 2018), https://perma.cc/W2SN-3E2E.

256 *See generally* David A. Cleveland & Quentin Gee, *Plant-Based Diets for Mitigating Climate Change*, *in* VEGETARIAN AND PLANT-BASED DIETS IN HEALTH AND DISEASE PREVENTION 135 (Francois Mariotti ed., 2017) (explaining that the current growth in greenhouse gases must be stabilized or reduced to avoid catastrophic effects).

257 Walter Willett et al., *Food in the Anthropocene: The EAT–Lancet Commission on Healthy Diets from Sustainable Food Systems*, 393 LANCET 447, 451 (2019).

258 *Id.* at 472.

259 *Id.*

260 Peter Scarborough et al., *Dietary Greenhouse Gas Emissions of Meat-Eaters, Fish-Eaters, Vegetarians and Vegans in the UK*, 125 CLIMATIC CHANGE 179, 179 (2014).

261 *Id.* at 186.

262 *Id.*

263 *See* Milman, *supra* note 253 (reporting on a 2018 study that found the Earth had only a 5% chance of avoiding warming by 2°C before the end of the century).